

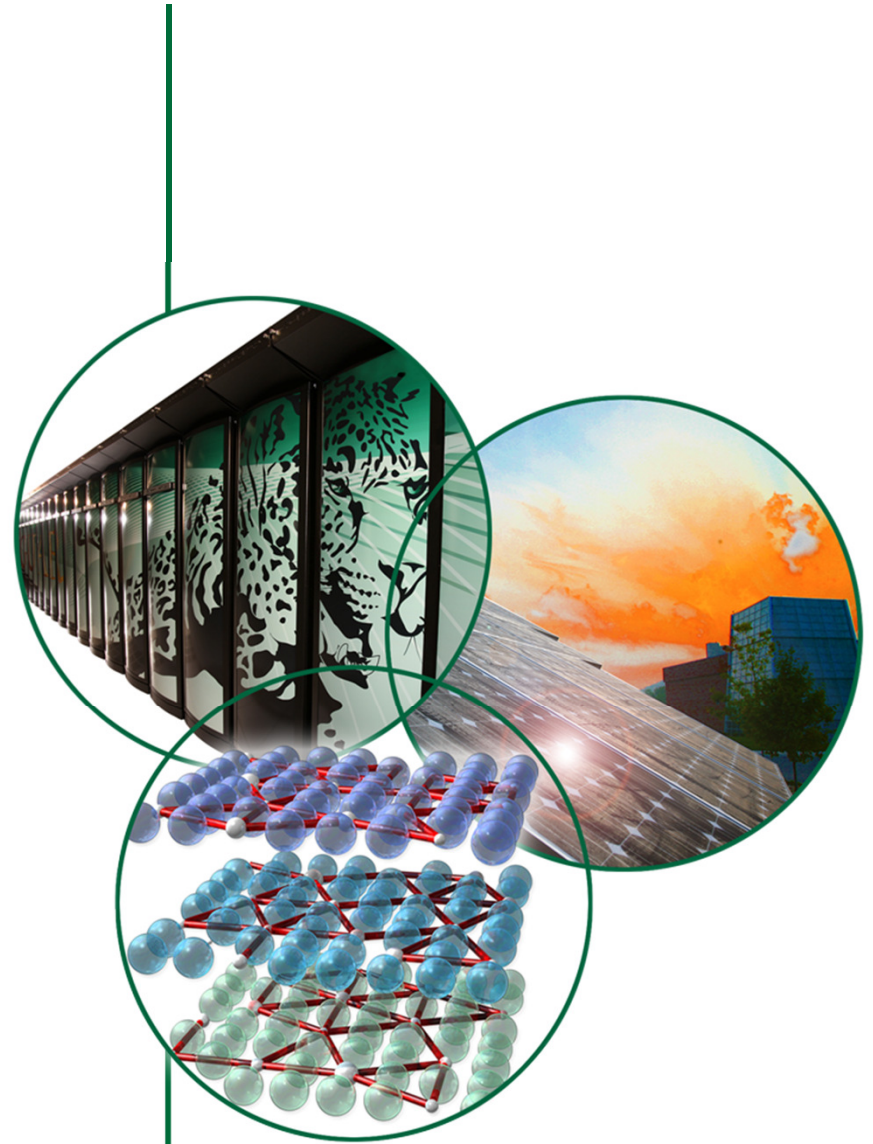
# Demonstration and Testing of ClimaStat® for Improved Rooftop Air-Conditioning Efficiency

Presented at IA Technology  
Deployment Working Group Meeting

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# Demonstration/Testing of ClimaStat® for Improved Efficiency of RTU Air Conditioners

- Technology from Advantek Consulting
  - Patented by Dr. Michael West in 2003. (US Patent #6427454)
  - Originally demonstrated under DOE's Inventions & Innovations program.
- Current demonstration sponsored by DOD's ESTCP program
- Uses off-the-shelf components to either...
  - Modify existing packaged air conditioners, or
  - Incorporate changes into new RTU equipment before installation
- Initial tests show 15% improvement in HVAC efficiency.
- Results obtained by by both...
  - Increasing quality of liquid refrigerant in evaporator coil, and
  - Modulating quantity of bypass air to more effectively control latent cooling
- Currently being demonstrated at...
  - Marine Corps Air Station Beaufort, SC. Retrofit of ClimaStat® to existing unitary A/C units.
  - Patrick Air Force Base, FL. ClimaStat® installed in new unitary packaged A/C unit.

# Demonstration/Testing of ClimaStat® for Technology/Methodology Description

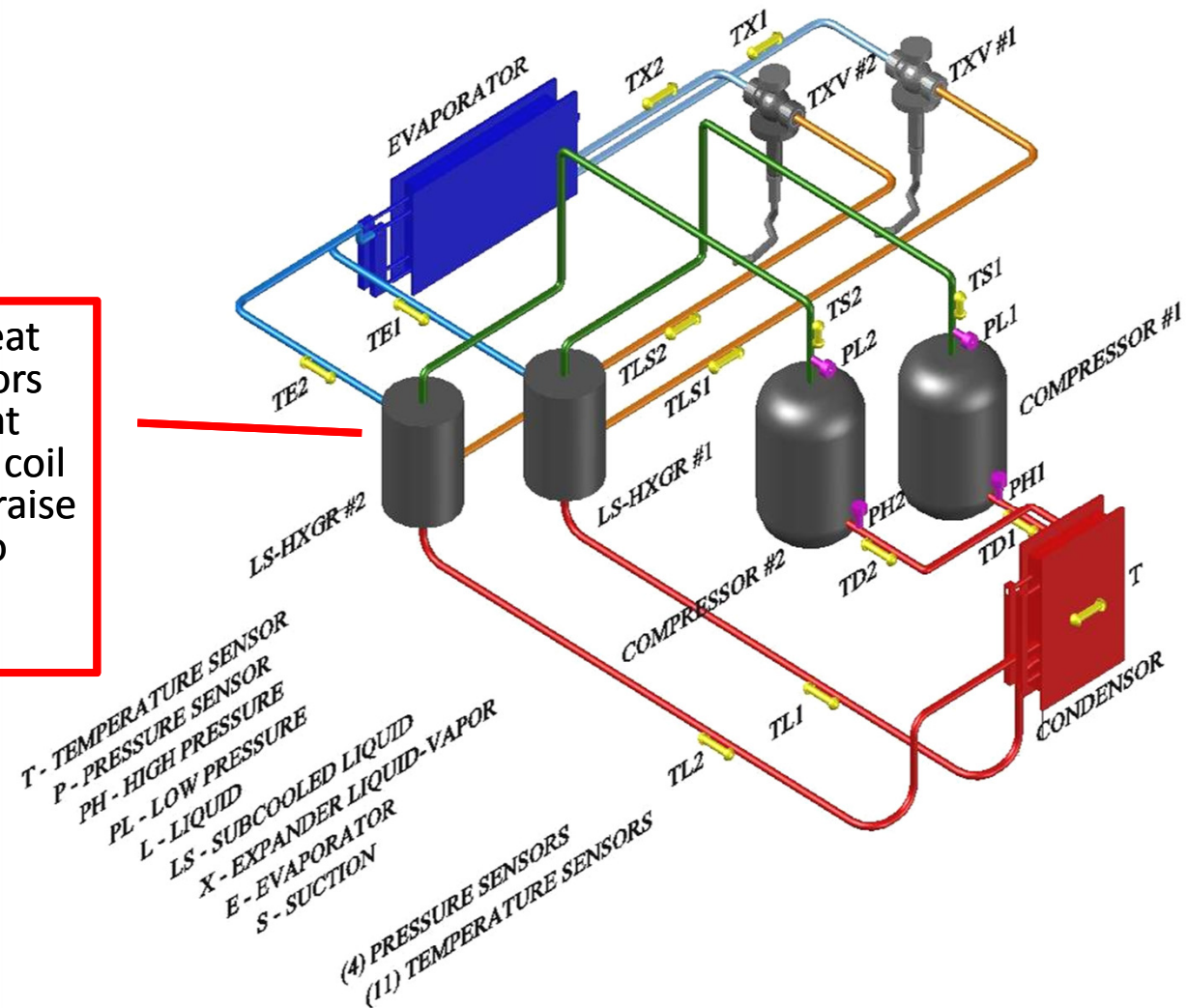
- Energy efficiency is increased by improving heat transfer coefficient and reducing compressor specific power.
  - ClimaStat® has high-quality cold liquid refrigerant flowing through the entire cooling coil, so the maximum coil / tube surface is always utilized for cooling.
  - In comparison, about one-third of a standard cooling coil contains vapor refrigerant.
- Energy use is reduced by optimizing sensible cooling capacity relative to electric power consumption over the cooling season.
  - ClimaStat® responds to varying latent (humidity) loads in addition to conventional sensible (temperature) load control.
  - A bypass damper allows air velocity over the cooling coil to decrease when dehumidification is needed. The re-combined air stream (bypass plus super-cooled air) is better suited to address high latent loads within the space.
  - In comparison, current unitary equipment cannot vary the proportion of sensible and latent cooling; latent loads “float” and only sensible load is controlled.
- ClimaStat® uses relatively simple, readily-available parts adapted from the food and industrial refrigeration industry.
  - Proven, reliable, familiar, easily maintainable, and low cost.

# Demonstration/Testing of ClimaStat® Refrigerant Loop, Schematic Diagram

## Technical Approach

Refrigeration-side sensor types and locations

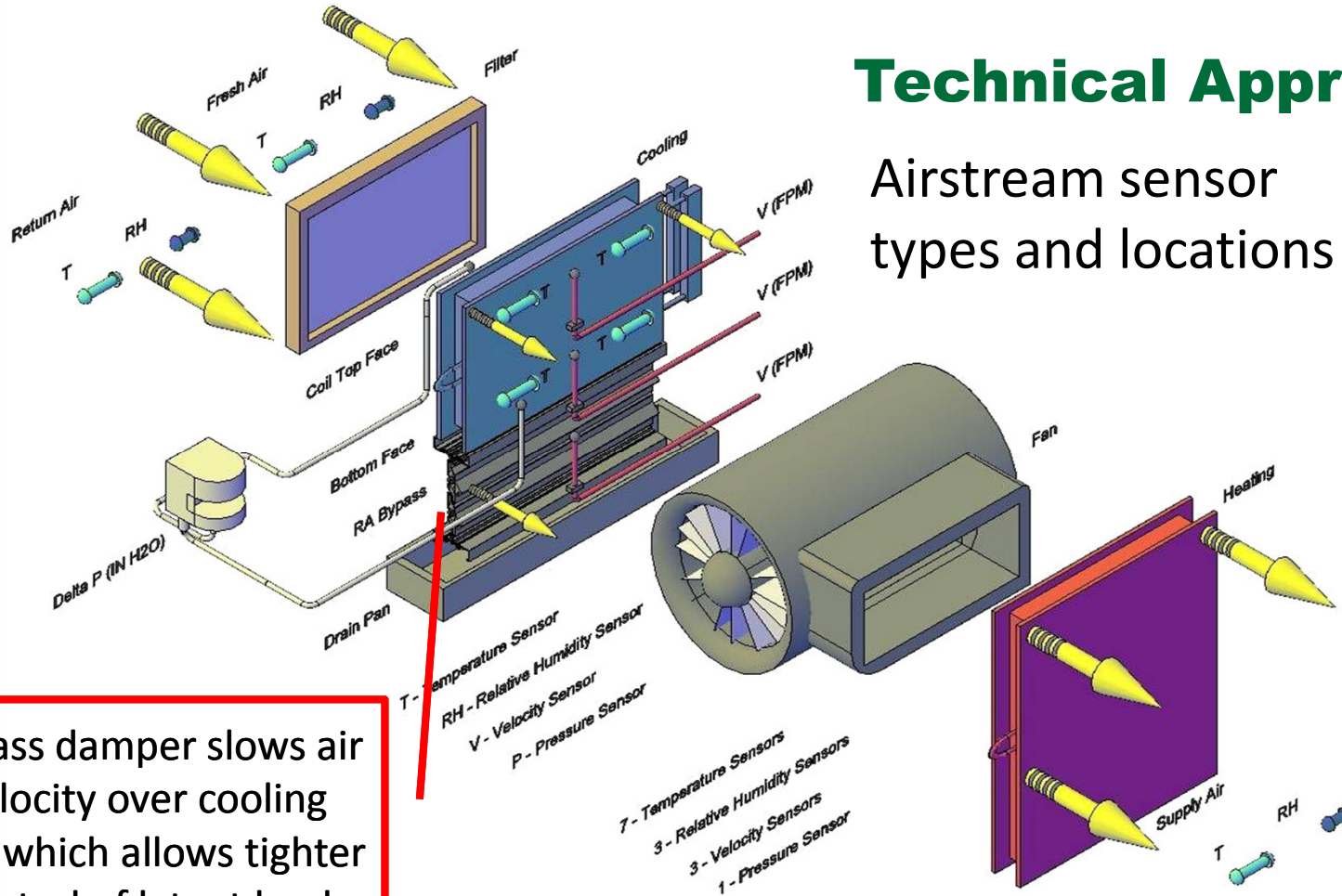
These liquid/suction heat exchangers/accumulators lower liquid refrigerant temperature to improve coil performance. They also raise vapor temperature to prevent slugging of compressors.



# Demonstration/Testing of ClimaStat® Airflow Path, Schematic Diagram

## Technical Approach

## Airstream sensor types and locations



Bypass damper slows air velocity over cooling coil, which allows tighter control of latent load when airstreams re-mix.

# Demonstration/Testing of ClimaStat® Site #1, MCAS Beaufort, SC (ESTCP)

**MCAS Beaufort** is a 6900-acre installation located 3 miles north of Beaufort, SC.



- MCAS Building 1283, the Base Exchange facility
- Mr. Neil Tisdale, CEM, Maintenance/Utilities Director
- 11 unitary air conditioning units located on the roof

MCAS Public Works staff identified RTU-2, a 20-ton Trane unitary A/C unit manufactured in 2003, as the best candidate for ClimaStat retrofit.

Building 1283 is connected to a base-wide direct digital control (DDC) network, which monitors operational status of RTU-2.

# Demonstration/Testing of ClimaStat® Site #2, Cape Canaveral AFS, FL (ESTCP)

**Cape Canaveral Air Force Station** is attached to **Patrick Air Force Base**, a 21,500-acre installation about 50 miles east of Orlando, FL and is located with NASA Kennedy Space Center (KSC) and Naval Ordnance Test Unit (NOTU).



A Trane model TCH090 7½-ton air-conditioning package unit manufactured 5/1999 at NOTU Building 1115, Hangar Y, EDL was selected for replacement.

It was replaced with a Carrier model 50HC-D009 8½-ton two-stage unit and a ClimaStat control thermostat-humidistat.

- Chris Cook, CEM, Resource Efficiency Manager
- Kevin Riley, PE, CEM, Energy Manager

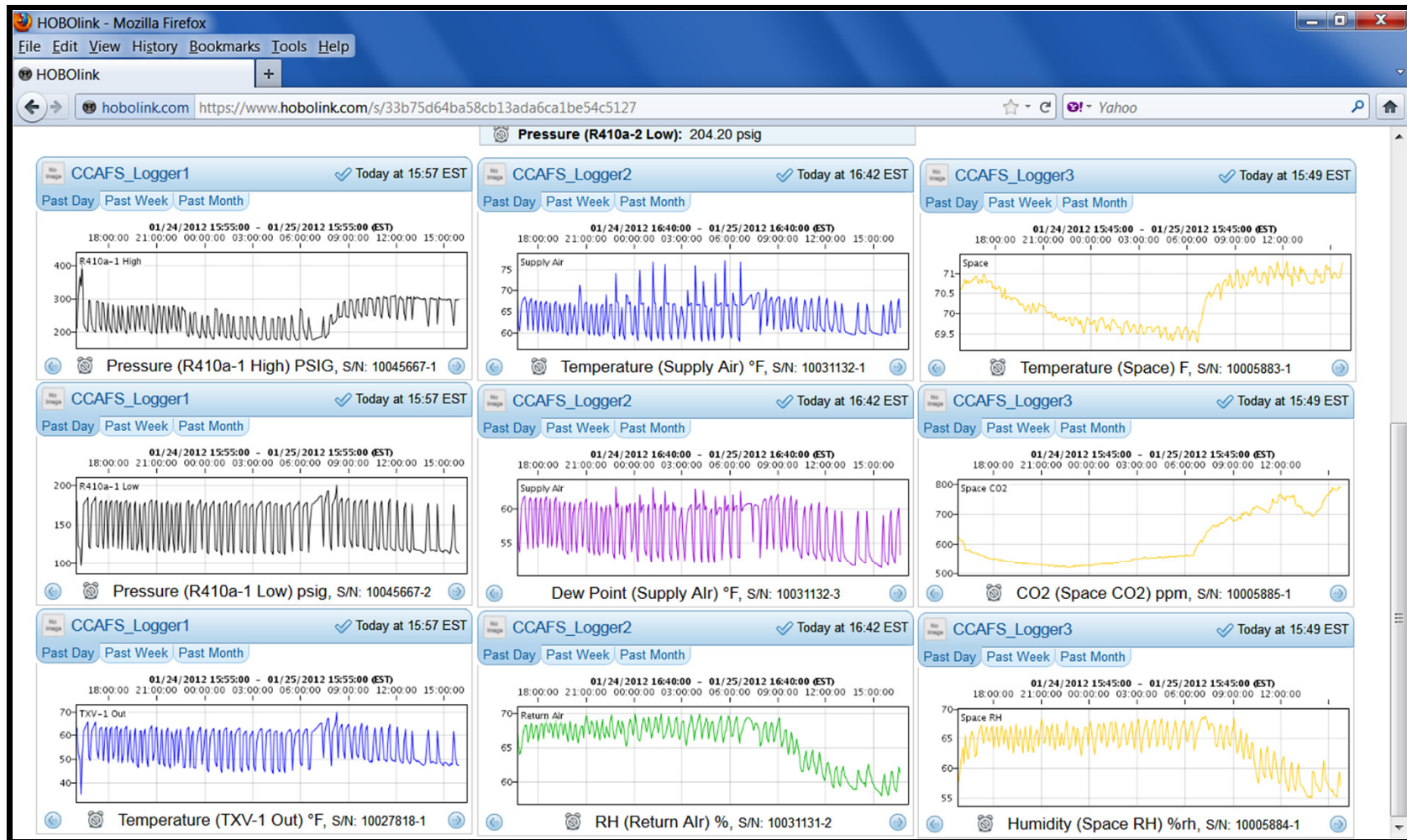
Coordinated demonstration approval with PAFB, CCAFS, and NOTU facility engineering personnel.

# Demonstration/Testing of ClimaStat® Site #2, Cape Canaveral AFS, FL (ESTCP)

Interior zone is a tightly controlled  
instrument development laboratory  
 $\pm 1$  degree-F,  $\pm 5\%$  rh



# Demonstration/Testing of ClimaStat® Sample of Remote M&V Capabilities



# Demonstration/Testing of ClimaStat®

## Sample of Remote M&V Capabilities

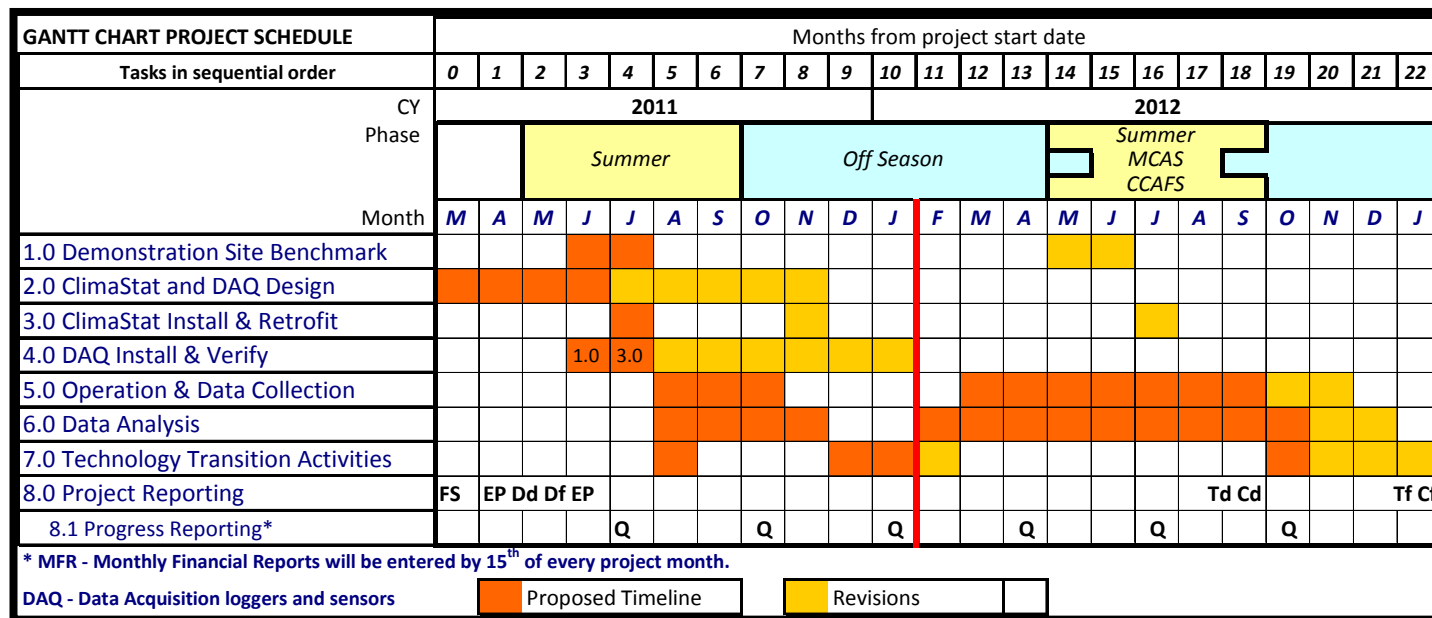


# Demonstration/Testing of ClimaStat® Technology Transfer Plan

| Target Audience                         | Planned Tech Transfer Tool  | Status of Implementation  |
|---|---|---|
| Original Equipment Manufacturers (OEMs) | Present performance data from ESTCP demonstration to OEM Product Managers         | Contacts made to inform of demos, Carrier Corp. provided unit for Cape Canaveral AFS. |
| DoD End-Users                           | Workshop at demo site; speaker at GovEnergy 2012 Conference; 2012 ESTCP Symposium | Pending cooling season data collection & analysis, GovEnergy speaker request          |
| DOE/FEMP Program                        | Coordinate w/High Performance RTU Challenge and ORNL, submit unit for testing     | DOE & National Lab contacts made  |
| Commercial End-Users                    | Trade show presentation & exhibit, magazine article                               | Identifying most interested end users and events                                      |
| HVAC Design Professionals               | Journal articles, webinar on ClimaStat demos, ASHRAE, LEED                        | Pending data collection & analysis  |

# Demonstration/Testing of ClimaStat® Proposed Upcoming Events

- Monitoring of test sites during Summer 2012
- Proposed presentation at GovEnergy, August 2012
- Working with ORNL/FEMP and High Performance RTU Challenge
- Seeking other DOD and commercial sites for possible deployment



# Demonstration/Testing of ClimaStat®

## Contact Information

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